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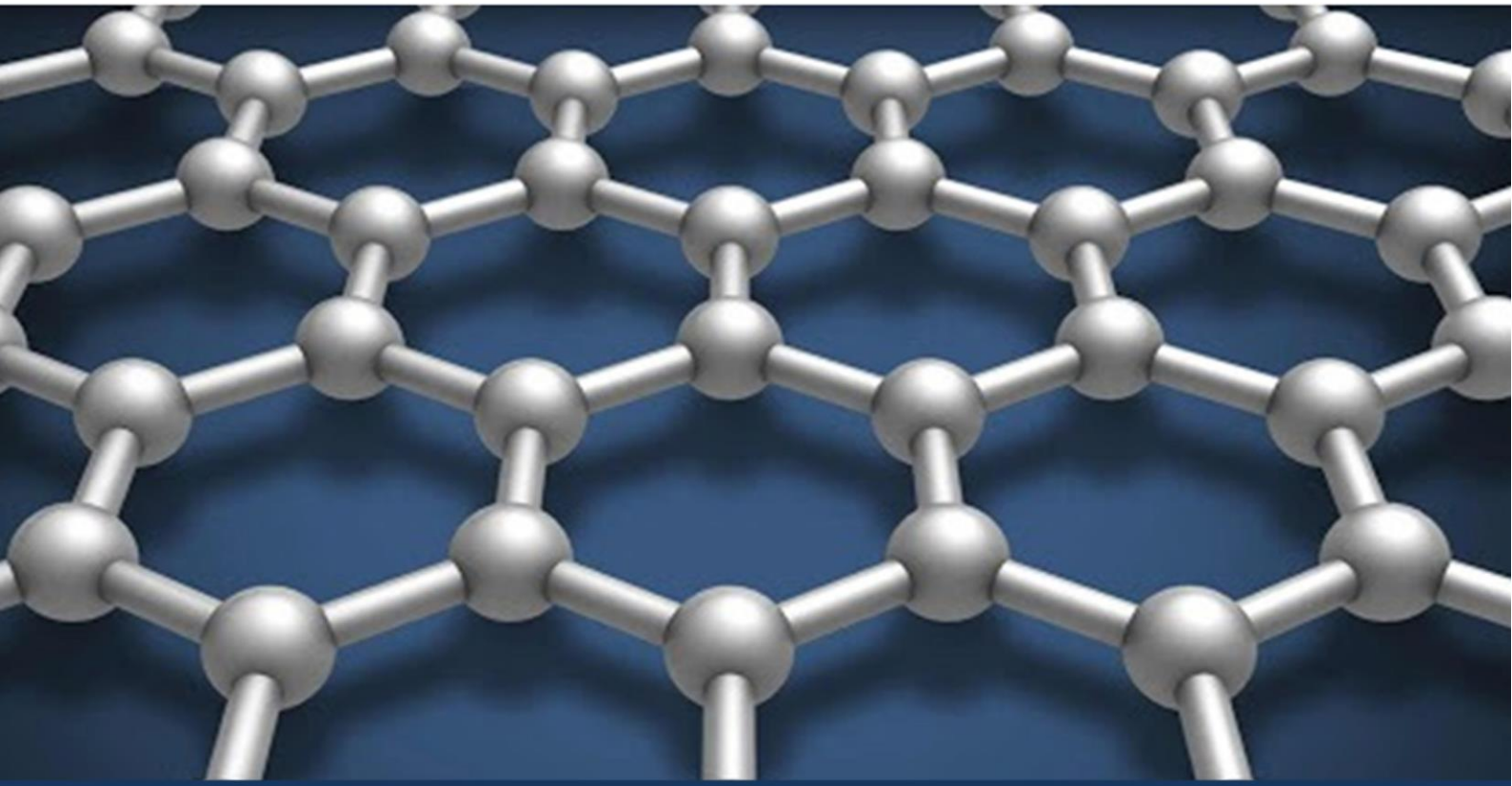
O‘zbekiston

Kompozitsion Materiallar

Ilmiy-texnikaviy va amaliy jurnali



Узбекский научно-технический и производственный журнал

Композиционные материалы

Аннотация: Ушбу мақолада Ангрен кўмирининг майдасидан брикетлар олишда ишлатиладиган ингредиентларнинг вазифаси кўрсатилган. Шу билан бирга ишлаб чиқилган кўмир брикетининг сиқилишдаги мустаҳкамлигига шихтанинг намлигининг таъсири аниқланган. Бунда шихтанинг намлиги 18-19 % дан ошмаслиги керак экан.

Меликулов Отабек Жамол ўғли ТошДТУ «Фан ва тараққиёт» ДУК мустақил тадқиқотчиси
Холмуродова Дилафруз Кувватовна Самарқанд давлат тиббиёт университети профессори

SOUND ABSORPTION OF RICE HUSK AS PROMISING BIOMASS FILLER OF NOISE REDUCING COMPOSITES

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The noise reducing composites encompass a class of materials which can be applied to the ceiling, floor and walls to decrease as much reflected sound as possible so that the room appears to be like a free space. Moderate reflection and good sound absorption can be achieved with porous media which show air flow resistance. The porous acoustic materials possess a cellular structure of interlocking pores. The oscillations of air molecules induced by elastic waves experience the friction with the solid material. Due to the friction the part of mechanical energy of motion is converted to the heat. Larger free surface of open pores of material lead to stronger losses. The foam elastomers are widely used in the automotive industry for solving the task of noise abating in vehicle cabins. While the material should satisfy numerous technical demands of safety. In order to meet the requirements to mechanical strength it is necessary to use fillers. There is a wide range of fillers from nanosize graphite and carbon nano tubes to silica particles [1]. The ecological issues attract attention to natural fibers, sawdust and other biomass-derived materials since they are less hazardous to human, than those made out of synthetic fibers. Natural fibers have many advantages compare to synthetic fibers, for instance low weight, low density, low cost, acceptable specific properties and recyclable or biodegradable [2, 3]. Fibers form open pores structure which possess low air flow resistance while other biomass-derived materials such as rice and buckwheat husks can be used as filler in acoustic composites. As a relatively large size of particles reduces the strength of the materials the dispersed husks can be used [4]. The possibilities of using buckwheat husk as an effective natural filler for acoustic composite materials have been sufficiently demonstrated in previous studies [5-7].

Among all cereal crops, rice production volumes are among the largest. After processing rice plants into cereals, waste remains: straw, bran and flower scales (husks). About 600 million tons of waste are generated worldwide every year. The mass fraction of rice husk is up to 20% of 30% of the total share of all waste. Uzbekistan produces 578 thousand tons of rice and about 115 thousand tons of husks. Disposal of this waste poses a serious problem both for Uzbekistan and throughout the world.

The purpose of this work was to experimentally study the sound absorption of rice husk as possible filler for noise-reducing composites. Of particular interest was the assessment of the effect of humidity on the frequency response of sound absorption in the range up to 6400 Hz from the point of view of the possible use of rice husks in open conditions when exposed to external atmospheric factors.

Materials and Research methods. The rise husk was obtained from cereal mill company located in Tashkent (Uzbekistan). The measured density of dry rice husk was about 90 kg/m^3. Sartorius MA150 Moisture Analyzer was used to measure the moisture content of rice husks.

Fig. 1 Image of rice husk in sample locus of impedance tubes with 100 mm (a) and 29 (b) inner diameter.

Two-microphone impedance tubes 4206 produced by Brüel & Kjær were used to measure the normal incident sound absorption coefficients of rice husk layers of three different thicknesses 10 mm, 25 mm and 40 mm. The impedance tube was vertically oriented and the loudspeaker was on the top. The fixed amount of rice husk was enclosed into the large and small tubes as it is shown in Fig. 1. The thickness of the layer was defined by graduated rod. A loudspeaker radiated white noise signal, generated by the built-in function generator unit. According to the ISO 10534-2 two microphones measurements allowed to determine the transfer function and normal absorption coefficient in the frequency range from 50 Hz up to 6400 Hz. The acoustic measurements were carried out at room temperature of 20±2ºC and relative humidity of 60±10%.

The results of the measured sound absorption coefficient are presented in Fig. 2. The sound absorption coefficient of 10 mm layer is frequency dependent and has a maxima of magnitude above value of 0.55 at 5.6 kHz. Increasing the thickness of rise husk layer shifts the first local maxima of sound absorption to the lower frequency; thus, thicker layer of rice possess better absorption at lower frequencies.

As one of the possible applications of these materials could be noise-protective barrier structures exposed to atmospheric factors, it was of interest to study the dependence of the sound-absorbing characteristics on the moisture content absorbed by the material from the environment. Figure 3 shows the measurement results of the sound absorption coefficient of a 25 mm layer of rice husk for various moisture contents ranging from 6% to 85%. It is noted that one of the advantages of materials based on rice husks in comparison with traditional foamed materials is that the frequency response of sound absorption of rice husks has a relatively weak dependence on moisture content. As shown in Fig. 3, increasing the moisture content from 6 to 55% almost does not change the level of sound absorption performance. At extreme levels of moisture content, the sound absorption characteristic has a decline in the frequency range 0.7 - 3.4 kHz, but a significant increase, up to the maximum values (0.99) of the sound absorption coefficient in the range 3.4 - 6.4 kHz.

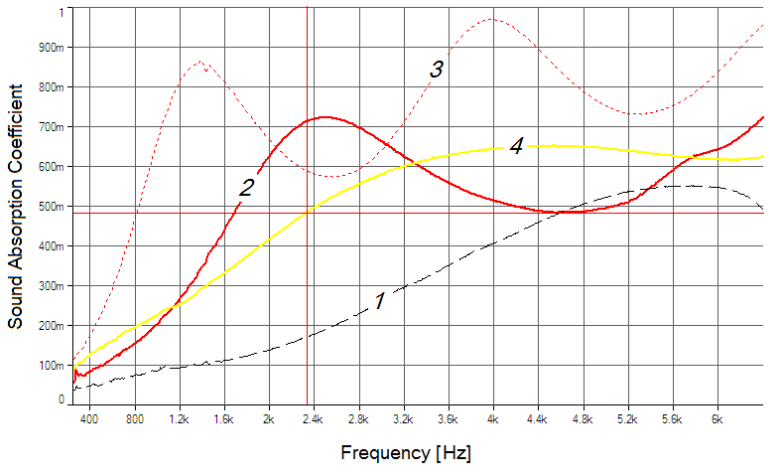

Fig. 2 Measured normal absorption coefficient of rice husk layers of different thickness: *1* – 10 mm; *2* – 25 mm; *3* – 40 mm; *4* – polyurethane foam 25 mm thickness (for comparison)

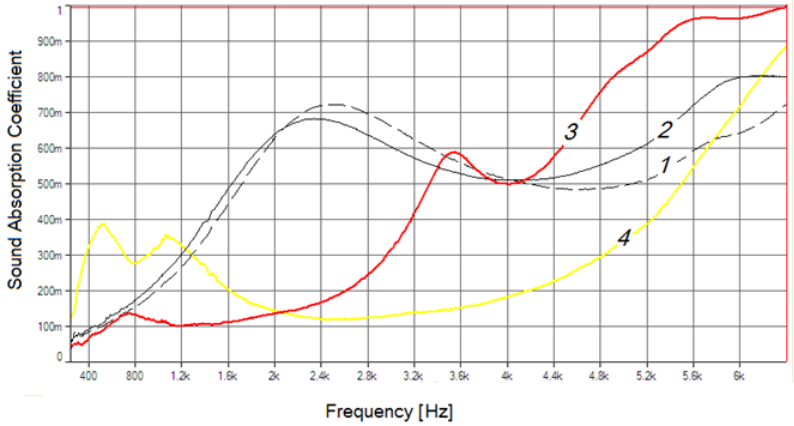

Fig. 3 Measured normal absorption coefficient of rice husk layer of 25 mm thickness of different moisture content: *1* – 6%; *2* – 55%; *3* – 85%; *4* – polyurethane foam (25 mm thickness) of 85% moisture content

7. Вести из лаборатории